The Immature Stages of the Genus *Rhabdomastix*
(Diptera : Tipulidae)

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Since Alexander's (1920) review of the knowledge of immature stages of the genus *Rhabdomastix*, no futher information about the American species has been published. Descriptions of the immature stages of *Rhabdomastix fascigera* Alex., *R. trichophora* Alex., *R. flaviventris* Alex., and *R. setigera* Alex., as well as a discussion of the relationships of *R. leonardi* Alex., *R. hynesi* Alex., *R. californiensis* Alex., and *R. lipophelps* Alex., are contained in this paper.

Rhabdomastix fascigera is widespread in its distribution, ranging from northern Washington to southern California and in altitude from sea level to eight thousand feet. The larvae are found in a wide variety of microhabitats: in streams to depths of four feet, in sand at the sides of streams, and on the rhizomes of mosses growing at the sides of streams. The larvae have a characteristic twisting-coiling behavior when disturbed, usually coiling around small twigs or strands of algae. Moreover, *R. fascigera* exudes a sticky substance from the anal opening which aids in holding it in position in the stream. This phenomenon has not been observed in any other member of the tribe Eriopterini, but has been noted in several members of the genus *Hexatoma* in the *Limnophilini.*

In the sandy area of their restricted geographical ranges, *R. trichophora*, *R. hynesi*, and *R. leonardi* are also found with *R. fascigera*. *R. setigera* and *R. flaviventris* occupy habitats in which the sand is finer and drier than that characteristic of the habitat of *R. fascigera.*

Descriptions or discussions of the last instar larvae and the pupae are based on the following numbers of specimens: *Rhabdomastix fascigera* (larvae—20, pupae—10), *R. subfascigera* (larvae—4, pupae—2), *R. lipophelps* (larvae—2, pupae—1), *R. californiensis* (larvae—4, pupae—1), *R. trichophora* (larvae—20, pupae—5), *R. leonardi* (larvae—10, pupae—5), *R. hynesi* (larvae—6, pupae—2), *R. setigera* (larvae—20, pupae—5), *R. flaviventris* (larvae—20, pupae—10).

RHABDOMASTIX (SACANDAGA) FASCIGERA Alexander

Last Instar Larva.—Length 16.6–22.9 mm; dextrosinistral and dorsoventral diameters both 0.6–0.9 mm. Body cylindrical with numerous microscopic yellow setae, becoming brownish-gold at posterior of eighth segment and anterior of ninth segment. Pencils of elongate setae reduced. Abdominal segments without

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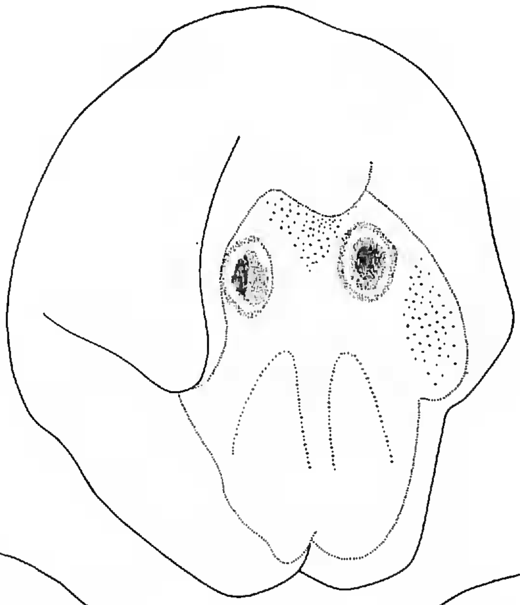

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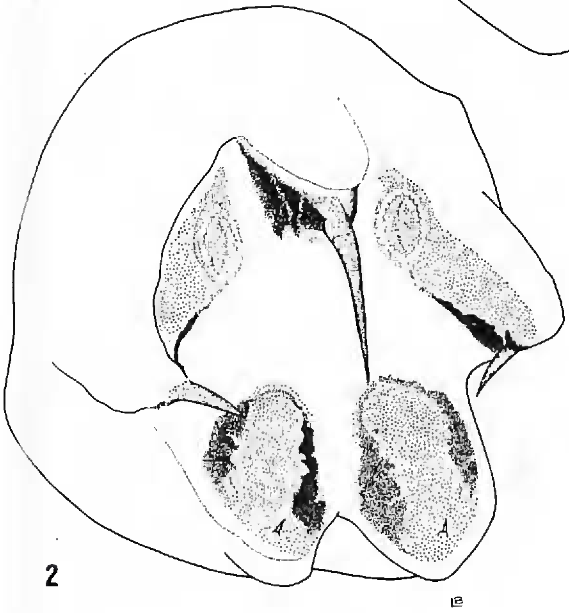

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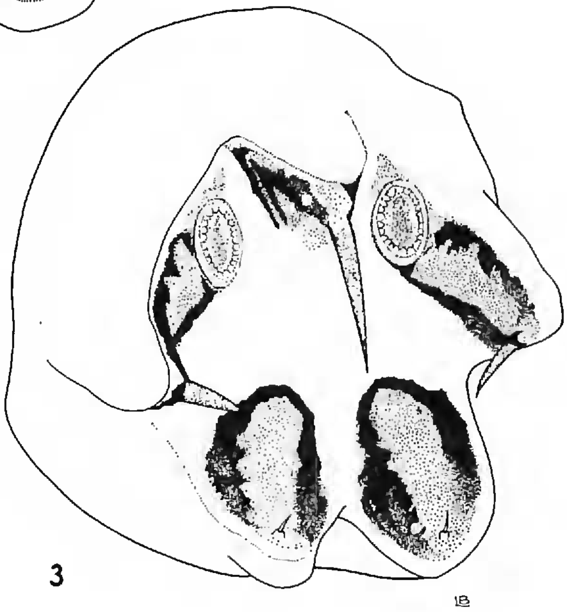

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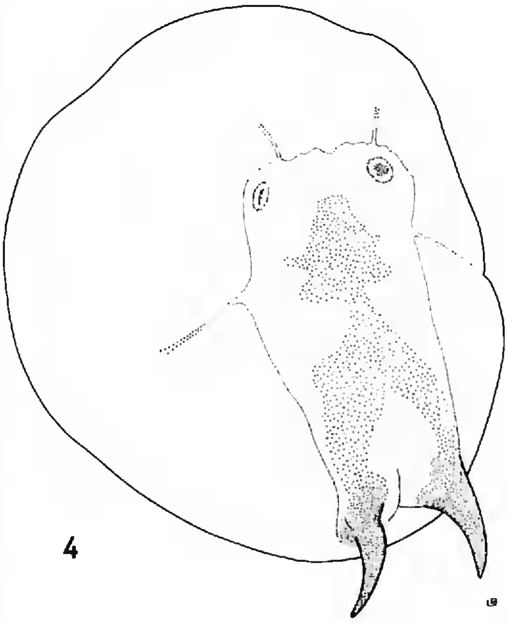

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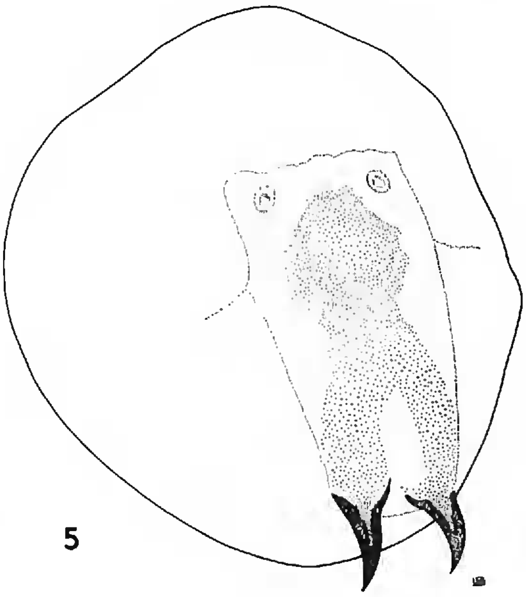

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creeping welts. Spiracular disk (fig. 1) obliquely truncate with five fleshy lobes; markings on face of lobes slightly colored; spiracles dark brown, ringed with lighter brown on margins. Four slender, white anal gills, subequal in length, tapering to rounded points at distal ends. Head capsule (fig. 6) typically eriopterine, sclerotization generally weak, length 0.784–0.860 mm (from posterior margin of maxillary segment to anterior apices of labrum), width 0.136–0.170 mm (at posterior mandibular articulation), depth 0.102–0.145 mm, dorsal bars longer than lateral or ventral bars, curving basally at tips, triangular plates lightly sclerotized except at margins of premaxillary suture, heavy sclerotization at caudal margins of suture, lateral bar half thickness of dorsal or ventral bar, labial portion of ventral bar slightly thickened, continuing forward as slender rod until joining submental and premental apparatus, anterior end of bar not expanded or toothed, maxillae elongate, extending beyond tip of labrum, pointed and curved slightly laterad distally, mandibles toothed with tips inclined ventral and mesad from lateral and dorsal articulation.

Pupa.—Length 7.7–9.0 mm; dextrosinistral diameter 1.12–1.20 mm; dorsoventral diameter 1.10–1.15 mm. Body (fig. 9) pale yellow, wing pads dark brown to black. Antennal scape with three spines spaced equally along ventral edge medially, frontally, and laterally, with spine located immediately below lateral spine and in line with spine located at cephaloventral edge of eye sheath, another series of spines located in facial margins in groups of four on both sides of body. Pronotum with medial tubercle appressed closely over flagellar portion of antennal sheaths, lateral tubercle with three or four elongated setae; mesonotum with lateral carina ending in small slit indicating tuberculate mesonotal breathing horns; medial carina raised, sharp, ending at pseudosuture. From pseudosuture a thin brownish line divided by white line extends over dorsal crest, dorsal crest brown except in areas next to patch of heavy spines. Spiracular openings simple, not projecting laterally. Leg sheaths end midlength of fourth abdominal segment, prothoracic and mesothoracic leg sheaths subequal in length, metathoracic sheaths longer. Male cauda with spiracular area depressed, rising abruptly to four large spines forming transverse row. Sheaths of inner dististyles bulbous at bases, narrowing abruptly, curving dorsally, and becoming pointed at tips, sheaths of outer dististyles flat, joined along entire length, curving mesally at tips. Female cauda with only remains of spiracular openings as disk markings. Cauda with four large spines, each with single elongate seta. Anteapical spines of tergal valve directed sharply dorsad; sternal valves with distal tips remaining in contact with bulbous tergal valves along their entire length.

RHABDOMASTIX (SACANDAGA) TRICHOPHORA Alexander

Last Instar Larva.—Length 15.0–16.8 mm; dextrosinistral and dorsoventral diameters both 0.55–0.60 mm. Body description similar to *Rhabdomastix fascigera*

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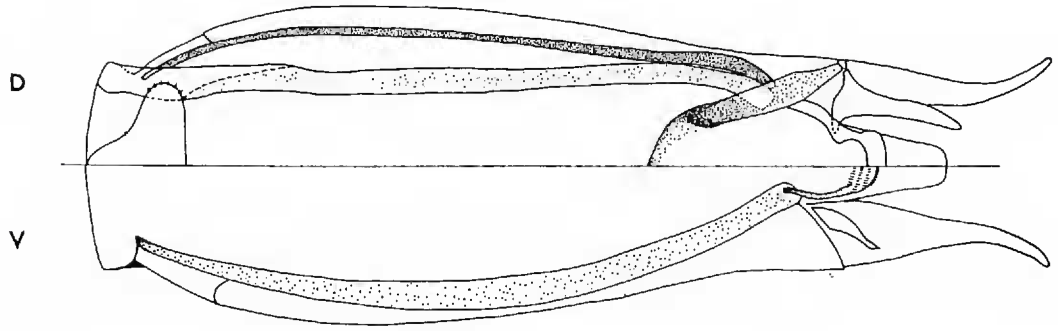
FIG. 1. Three-quarter view of spiracular disk of *R. fascigera.* FIG. 2. Three-quarter view of spiracular disk of *R. trichophora.* FIG. 3. Three-quarter view of spiracular disk of *R. californiensis.* FIG. 4. Three-quarter view of spiracular disk of *R. flaviventris.* FIG. 5. Three-quarter view of spiracular disk of *R. setigera.*



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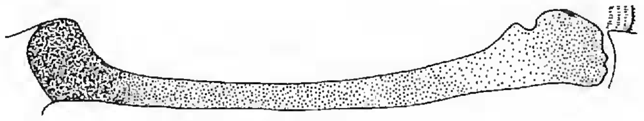

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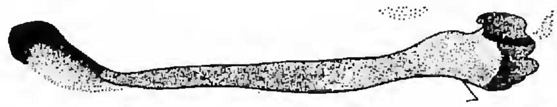

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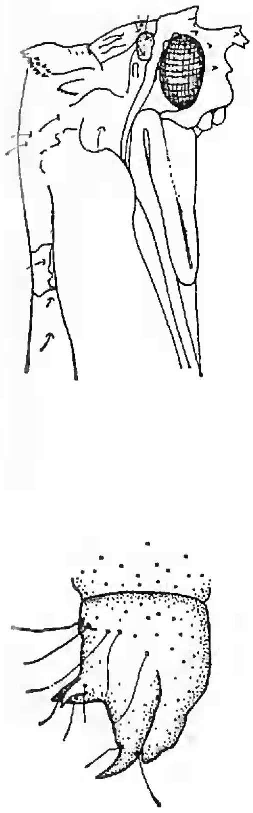

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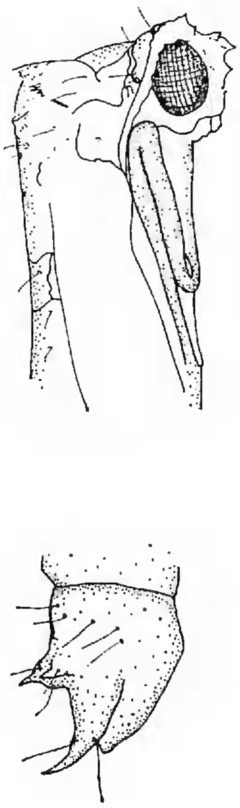

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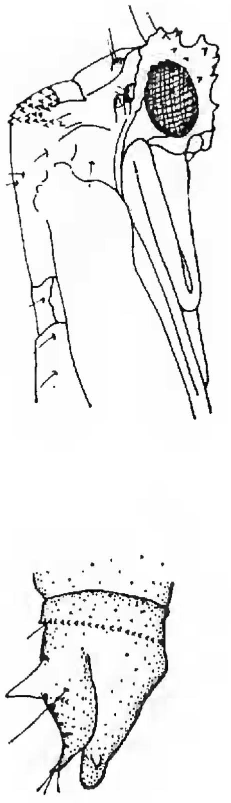

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with following exceptions. Fine yellow, closely appressed, microscopic setae not as numerous as in *R. fascigera.* Pencils of setae evident. Head capsule similar to that of *R. fascigera;* length 0.582–0.607 mm, dextrosinistral diameter 0.101 mm, dorsoventral diameter 0.250–0.304 mm. Posterior spatulate plates bent slightly laterad, triangular plate merely touching inner edge of spatulate area. Spiracular disk (fig. 2) with five fleshy lobes; dorsal lobe ending in thick, horny tubercle projected caudally, narrowing to sharp, ventrally directed point; dorsolateral lobes with large horny spine near tip of lobe directed mesad, lower edge with thin, dark brown stripe, upper edge with barely discernible marking, triangular area above spiracles dark brown, center of spiracles yellow with rims of spiracles same color; anal lobes fleshy and white, larger and pointed at lateral margins.

Pupa.—Length 6.5–8.5 mm; dorsoventral and dextrosinistral diameters both 0.8–0.9 mm. General description similar to *R. fascigera* except for following details. Heavily sclerotized, transverse mesonotal ridge followed by a series of smaller ridges less heavily sclerotized behind spines of dorsal crest (fig. 10). Few or no spines forming posterior transverse line on dorsum of abdominal segments four, five, and six. Male and female cauda similar to that of *R. fascigera* except for small spines in area homologous to spiracular disk of larva.

RHABDOMASTIX (SACANDAGA) CALIFORNIENSIS Alexander

Last Instar Larva.—Length 12.0–16.1 mm; dextrosinistral and dorsoventral diameters both 0.45–0.55 mm. Larval and pupal characteristics essentially similar to those of *Rhabdomastix trichophora* except for following details. Dorsolateral lobe of spiracular disk with ventral and dorsal stripe of dark brown, center of spiracle yellow, ventral circumference dark brown, remainder of circumference yellow or same color as center of spiracle (fig. 3).

Pupa.—Length 5.48–5.70 mm; dextrosinistral diameter 0.66–0.75 mm; dorsolateral diameter 0.70–0.73 mm. Series of smaller ridges behind mesonotal ridge lacking.

RHABDOMASTIX (SACANDAGA) LEONARDI Alexander

Last Instar Larva.—Length 12.5–16.6 mm; dextrosinistral and dorsoventral diameters both 0.45–0.55 mm.

Pupa.—Length 8.0 mm; dextrosinistral and dorsolateral diameters both 1.0 mm. Remainder of larval and pupal characteristics similar to those of *R. californiensis.*

RHABDOMASTIX (SACANDAGA) HYNESI Alexander

Last Instar Larva.—Length 14.6–18.5 mm; dextrosinistral and dorsoventral diameters both 0.55–0.60 mm.

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FIG. 6. Head capsule of *R. fascigera*; D = dorsal view, V = ventral view. FIG. 7. Ventral (maxillary) bar and maxillary plate of *R. setigera.* FIG. 8. Ventral (maxillary) bar and maxillary plate of *R. flaviventris.* FIG. 9. Lateral views of anterior and caudal ends of pupa of *R. fascigera.* FIG. 10. Lateral views of anterior and caudal ends of pupa of *R. trichophora.* FIG. 11. Lateral views of anterior and caudal ends of pupa of *R. setigera.*

Pupa.—Length 8.1–9.6 mm; dextrosinistral and dorsoventral diameters both 0.9–1.0 mm. Remainder of larval and pupal characteristics similar to those of *R. californiensis.*

RHABDOMASTIX (SACANDAGA) SETIGERA Alexander

Last Instar Larva.—Length 11.6–14.0 mm; dextrosinistral and dorsolateral diameters both 0.6–0.7 mm. Body whitish yellow, cylindrical, tapered at anterior end; thoracic segments slightly expanded at eighth abdominal segment. Spiracular disk (fig. 5) flat, tapering gently from face obliquely to tips of ventral spines; dorsal and dorsolateral lobes not discernible. Markings on spiracular disk forming inverted Y with stem between spiracles, marking in upper center of disk at base of Y nearly diamond shaped, continuing basad, indenting medially, then expanding and continuing in separate arms to base of spines, spiracles small, reddish-brown in centers with outer rims lighter, ventral lobes end in thick spines curving basally; four bulbous, white anal lobes, posterior lobes approximately twice length of anterior pair. Head capsule different from that of *Rhabdomastix fascigera*; length 0.633 mm.; dextrosinistral diameter 0.136–0.145 mm; dorsoventral diameter 0.171–0.195 mm; antennal buttress continuing forward and medially into heavily sclerotized anteclypeal fold, antennae four to five times as long as wide, lightly sclerotized; papillae elongate, ending approximately one-quarter the distance from tip of maxillae; maxillae expand to tip of labrum, blunt and glove-shaped; mandible heavily sclerotized and angled basally and mesally; hypopharynx sclerotized, anchored to inner margins of maxillary plate; maxillary plate expanded at anterior tip of maxillary bar, ending in three or four small blunt teeth anteriorly (fig. 7), separated centrally by small thin membranous area.

Pupa.—Length 6.3–7.6 mm; dextrosinistral diameter and dorsoventral diameters both 1.0–1.1 mm. Frontoclypeal area, eye and antennal sheaths with spines. Antennal sheath crenate on basal margin. Anterior margin of pronotum with small lobe on either side of median carina; posterior to these small lobes are two more bulbous lobes each with two setae directed dorsally; beneath these is a large, ridged lobe at lateral margin of, and overhanging, antennal sheath; breathing horns small, bulbous; median carina with small transverse ridges on either side extending from anterior margin of mesonotum to pseudosuture, median line forming slight V-shaped dip up to and beyond dorsal crest at pseudosuture. Patch of spines (fig. 11) covering dorsal crest, medial spines larger, becoming smaller laterally; area posterior to dorsal crest slightly ridged or variegated to posterior margin of mesonotum. Base of haltere sheath visible as slight expansion near dorsal margin of wing pad. Leg sheaths end approximately midlength of abdominal segment four. Male cauda with gonosheath thick, bulbous at base with spine laterally directed at tip of sheath. Inner diststyle with base thick, then abruptly thinner, ending in spine at tip; sheath bulbous at base, narrowing to spines at tip. Small tubercle directed caudally between bases of tergal arms, transverse row of small spines laterally at base of each tergal arm. Female cauda with tergal arms similar to those of male, tergal valve sheath with ridges on dorsal surface to dorsally directed spine, three or four setae found caudally at base of spine. Ventral side of sternal sheath ridged, curving dorsally to unarmed tip. Abdominal segments two through seven with two to three folds except for abdominal segment eight with spines on lateral edges of sternum but not on medial sternal area or on pleural area.

RHABDOMASTIX (SACANDAGA) FLAVIVENTRIS Alexander

Last Instar Larva.—Details same as given for *Rhabdomastix setigera* with exceptions as follow. Head capsule with maxillary plate (fig. 8) having anterior teeth much more pronounced than in *Rhabdomastix setigera.* Spiracular disk (fig. 4) with inverted Y much lighter brown than in *R. setigera*, stem of Y divided down medial line by whitish-yellow stripe, base of Y much thicker with lateral margin nearly straight line to base of ventral lobe spine, inner margins of arms of Y slanting from center of disk to base of spines.

Pupa.—The pupa of *R. flaviventris* cannot be separated from that of *R. setigera* on basis of specimens in my possession.

DISCUSSION

A basic problem arises in trying to explain the relationships of these species which show two very different types of larval forms, but which differ only slightly in the adult stages. The species under discussion may be divided into three groups based upon the morphological characters of the immature stages given above. The first of the three groups will be called the *fascigera* group. I have reared specimens of *R. subfascigera* and *R. lipophleps*, and found them to be similar in external morphology to *R. fascigera.* Many characteristics were investigated, but the materials in my possession do not allow separation of larval or pupal specimens of these species with any degree of confidence. However, separation by their known geographical ranges is possible with the exception of those found in the northern Washington area. In this area, I have reared *R. fascigera* at 2000 feet, and from the same stream have also reared *R. subfascigera* at 5000 feet.

The second group will be referred to as the *thichophora* group, consisting of *R. trichophora, R. californiensis, R. leonardi,* and *R. hynesi.* These specimens are similar to each other and to the *fascigera* group in body form and morphology of the head capsule. They differ from the *fascigera* group in details of the spiracular disks. There is no trouble in separating larvae of *Rhabdomastix trichophora* from the other species; however, I cannot separate larval specimens of *R. californiensis*, R. *leonardi*, and *R. hynesi.* Again, separation of these species can be made on the basis of geographical location. I have not been able to separate pupal stages of any species in this group on the basis of morphology, but can easily separate them as a group from the *fascigera* and *lurida* groups.

The third group has been referred to as the *lurida* group (Alexander, 1943) of which *R. setigera* and *R. flaviventris* have now been reared. The larvae are different from those of the other groups in body form, especially in the ratio of length to width, in morphology of the spiracular disk, and in many details of the head capsule, especially the toothed maxillary plate at the anterior end of the ventral bar.

Investigations to determine whether or not members of each of the groups are conspecific on the basis of adult characteristics were considered beyond the scope of the present project. Based on morphological characters found in the head capsule and in the spiracular disk, the *fascigera* and *trichophora* groups are more closely related to each other than to the *lurida* group. Pupal and, to a greater extent, adult characters place the *lurida* group in the genus *Rhabdomastix.* These pupal characteristics of the *lurida* group are the shape and structure of the frontal and cephalic crest areas. The characteristic adult features involve wing venation and the genital structures.

There are two possible explanations of the differentiation seen in these groups. The first explanation is that the larval stages of these groups have progressed in their evolution to such an extent that they show a greater magnitude of divergence than do the adult stages. This explanation would, moreover, indicate that the species belonging to the *lurida* group are correctly considered to be a part of the genus *Rhabdomastix.* The basis for the generic definition of *Rhabdomastix* is the morphology of the adult stage. If we use characteristics of this stage alone as our criteria for the genus, there are two morphologically distinct types of larvae in one genus—a rare situation in the family Tipulidae and inconsistent with general concepts of the generic category in cranefly families.

The second possible explanation is that the larval stages of the *lurida* group have retained their original lines of differentiation and have continued their own development along divergent lines. The adult stages have converged with those of the *fascigera* and *trichophora* groups on the basis of comparisons of wing venation and genital structure. Alexander (1920) considered the genus *Rhabdomastix* to be closely allied to the genus *Gonomyia.* The *lurida* group, with characteristics of the larval head capsule such as the toothed maxillary plate, details of the frontoclypeal area, shape of the head capsule, as well as the absence or near absence of lobes on the spiracular disk, may be more closely related to the genus *Teucholabis* in which these characteristics are also present.

The evidence also suggests that members of the *lurida* group are not correctly classified to the generic level and that, with further study, a new genus may have to be proposed to indicate correctly the relationship between the genus *Rhabdomastix* and the genus *Teucholabis.*

LITERATURE CITED

ALEXANDER, C. P. 1920. The crane flies of New York. Pt. II. Biology and phylogeny. N. Y. Agr. Exp. Sta. Ithaca Mem., 38: 699–1133, 87 pls.

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SCIENTIFIC NOTES

The location of the holotypes of *Bruchus cubiculus* Casey and *Mylabris wheelocki* Blatchley (Coleoptera: Bruchidae).—In an earlier paper I discussed the problems involved in locating type-specimens of Bruchidae deposited in museums in the United States, listed where types were located and designated some lectotypes (Johnson, 1968, Ann. Entomol. Soc. Amer., 61: 1266–1272). The present note lists pertinent information concerning the holotypes of two species not included in the above paper, *Mylabris wheelocki* Blatchley (Blatchley, 1930, Can. Entomol., 62: 35) and *Bruchus cubiculus* Casey (Casey, 1884, Contributions to the Descriptive and Systematic Coleopterology of North America. Part II. p. 183).

The holotype of *M. wheelocki* is deposited in the Entomology Research Collection, Purdue University, Lafayette, Indiana. Through the kindness of Ross H. Arnett, Jr. and Eric H. Smith I was able to examine the specimen and found it bears the following labels: "3837," "TYPE," "Royal Palm Park, Fla. WSB, 3-21-29," "*Mylabris wheelocki* sp. nov." According to Dr. Smith (and Blatchleyana, 1930, p. 59) this is Blatchley Type #374.

The holotype of *B. cubiculus* is deposited in the United States National Museum. Dr. John M. Kingsolver relayed to me that the specimen bears an "Ari." label and bears type number 49229.

L. J. Bottimer (1968, Can. Entomol., 100: 1034, 1035) included both species in the genus *Megacerus* and discussed the taxonomic status of *Megacerus cubiculus*.—CLARENCE D. JOHNSON, Northern Arizona University, Flagstaff.